

REMARKS

Claims 1-20 are all the claims presently pending in the application. Claims 2-4 are amended to more clearly define the invention and claims 5-20 are added. Claims 1, 5, and 18 are independent.

These amendments are made only to more particularly point out the invention for the Examiner and not for narrowing the scope of the claims or for any reason related to a statutory requirement for patentability.

Applicants also note that, notwithstanding any claim amendments herein or later during prosecution, Applicants' intent is to encompass equivalents of all claim elements.

Applicants gratefully acknowledge that claims 3-4 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. However, Applicants respectfully submit that all of the claims are allowable.

Claims 1 and 2 stand rejected under 35 U.S.C. § 102(b) as being anticipated by the Yano et al. reference.

This rejection is respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

A first exemplary embodiment of the claimed invention, as defined, for example, by independent claim 1, is directed to a differential limiting control apparatus for a four wheel drive vehicle having clutch means for variably transmitting a driving force to a front drive shaft and to a rear drive shaft. The differential limiting control apparatus includes automatic clutch control

means for automatically calculating and establishing an engagement force of the clutch means according to traveling conditions of the vehicle, manual clutch control means for manually establishing the engagement force of the clutch means, and control selecting means for selecting either of the automatic clutch control means and the manual clutch control means and for commanding the selected one to output the engagement force.

A second exemplary embodiment of the claimed invention, as defined, for example, by independent claim 5, is directed to a differential limiting controller for a four wheel drive vehicle having a clutch that variably transmits a driving force to a front drive shaft and to a rear drive shaft. The differential limiting controller includes an automatic clutch controller that calculates an engagement force of the clutch, a manual clutch controller for manually controlling the engagement force of the clutch, and a controller selector that selects one of the automatic clutch controller and the manual clutch controller.

A third exemplary embodiment of the claimed invention, as defined, for example, by independent claim 18, is directed to a differential limiting controller for a four wheel drive vehicle having a clutch that variably transmits a driving force to a front drive shaft and to a rear drive shaft. The controller includes an automatic clutch controller that automatically controls an engagement force of the clutch, a manual clutch controller for manually controlling the engagement force of the clutch, and a controller selector that selects one of the automatic clutch controller and the manual clutch controller.

Conventional four wheel drive vehicles having a center clutch differential control have difficulty controlling vehicle driving performance while tire and/or road surface conditions and

driver skill levels vary.

One conventional four wheel drive vehicle attempts to address this problem by providing a manual clutch controller that allows a driver to manually control the engagement of a center differential clutch.

However, it is very difficult for a driver to optimally adjust the differential limiting torque using a manual clutch controller. For example, if a driver operates the manual clutch controller in a released condition, in an extreme case, the vehicle may spin in a low friction coefficient road surface condition. Further, if a driver operates the manual clutch controller in an engaged condition for a lengthy period of time and/or while the vehicle is operated at a higher speed, torque may be circulated within the powertrain of the vehicle which may, for example, adversely affect fuel economy.

In stark contrast, an exemplary embodiment of the present invention provides a controller selector that selects one of an automatic clutch controller and a manual clutch controller. In this manner, the present invention allows a driver to manually control engagement of the center differential clutch, but also is able to select the automatic clutch controller to avoid the manual controller from incorrectly engaging the center differential clutch under certain vehicle operating conditions (page 1, line 12 - page 2, line 23; page 3, lines 1 - 22; and page 36, line 11 - page 37, line 8).

II. THE PRIOR ART REJECTION

Regarding the rejection of claims 1-2, the Examiner alleges that the Yano et al. reference teaches the claimed invention. Applicants submit, however, that there are elements of the claimed invention which are neither taught nor suggested by the Yano et al. reference.

The Yano et al. reference does not teach or suggest the features of the present invention including a controller selector that selects one of an automatic clutch controller and a manual clutch controller (independent claims 1, 5, and 18). As explained above, this feature is important for providing an operator with manual control of a center differential clutch while maintaining the ability to select the automatic clutch controller to avoid the manual controller from incorrectly engaging the center differential clutch under certain vehicle operating conditions.

Rather, and in stark contrast, the Yano et al. reference merely discloses a clutch 7 that acts “either as an over-running clutch or a manual clutch” (col. 8, lines 47-48). In particular, when the clutch 7 operates as an over-running clutch, the “clutch 7 engages between output shaft 4 and input shaft 9 when the rotary speed of the input shaft 9 is slower than that of output shaft 4 . . . [and the clutch] disengages when the rotary speed of the input shaft 9 is the same as or faster than that of the output shaft 4.” (col. 8, line 65 - col. 9, line 7).

“In this regard, clutch 7 engages when input shaft 9 rotates slower than output shaft 4 and disengages when input shaft 9 rotates at the same speed or faster than output shaft 4.” (Col. 9, lines 14-17).

The Yano et al. reference further explains that “clutch 7 may also act as a manual clutch, which can be switched on and off by manual operation of a lever.” (Col. 9, line 66 - col. 10, line

1).

Contrary to the Examiner's allegations, the Yano et al. reference does not teach or suggest the features of the present invention including a controller selector that selects one of an automatic clutch controller and a manual clutch controller.

Indeed, the transmission that is disclosed by the Yano et al. reference suffers from exactly the same problems that are described in the "Field of the Invention" section of the specification of the present application and which are solved by the present invention. While the Yano et al. reference discloses a clutch 7 that is capable of automatically engaging when the rotary speed of the input shaft 9 is slower than that of the output shaft 4 and further discloses the ability to manually engage the clutch 7, the driving system of the working vehicle suffers from the same risk of the manual engagement of the clutch under adverse conditions.

The driving system of the working vehicle that is disclosed by the Yano et al. reference suffers from these problems because the driving system of the working vehicle does not include a controller selector that selects one of an automatic clutch controller and a manual clutch controller.

Further, the Yano et al. reference does not teach or suggest the features of the present invention including an automatic clutch control means for automatically calculating an engagement force of the clutch (claim 1). Rather, the Yano et al. reference merely discloses a clutch 7 that is constructed such that it engages when the rotary speed of the input shaft 9 is slower than that of the output shaft 4.

Indeed, the Yano et al. reference does not teach or suggest calculating anything at all, let

alone calculating an engagement force of a clutch.

Therefore, the Yano et al. reference does not teach or suggest each and every element of the claimed invention and the Examiner is respectfully requested to withdraw this rejection of claims 1-2.

III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing amendments and remarks, Applicants respectfully submit that claims 1-20, all the claims presently pending in the Application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the Application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

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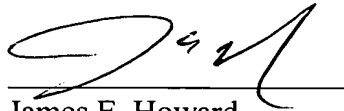
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Respectfully Submitted,

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